UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/755,381	01/05/2001	Evelyn Duesterwald	10990963-1	5203

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HEWLETT-PACKARD COMPANY
Intellectual Property Administration
P. O. Box 272400
Fort Collins, CO 80527-2400

EXAMINER
YIGDALL, MICHAEL J

ART UNIT	PAPER NUMBER
2122	5

DATE MAILED: 11/19/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	09/755,381	DUESTERWALD ET AL.
	Examiner	Art Unit
	Michael J. Yigdall	2122

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed
  after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any
  earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on _05 January 2001_.

2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is
closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) _1-20_ is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) _1-20_ is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☒ The drawing(s) filed on _05 January 2001_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage
application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

13) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application)
since a specific reference was included in the first sentence of the specification or in an Application Data Sheet.
37 CFR 1.78.

    a) ☐ The translation of the foreign language provisional application has been received.

14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific
reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _4_ .

4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: .

DETAILED ACTION

1.   Claims 1-20 are pending and have been examined. The priority date considered for the

application is 9 February 2000.

Claim Objections

2.   Claim 11 is objected to because of the following informalities: The phrase "a computer

readable comprising" in line 1 should be replaced with --a computer readable medium

comprising--. Appropriate correction is required. The claim has been interpreted assuming this

correction to be made.

Claim Rejections - 35 USC § 102

3.   The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the

basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed
> in the United States before the invention by the applicant for patent or (2) a patent granted on an application for
> patent by another filed in the United States before the invention by the applicant for patent, except that an
> international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this
> subsection of an application filed in the United States only if the international application designated the United
> States and was published under Article 21(2) of such treaty in the English language.

4.   Claims 1, 4, 5, 11, 14 and 15 are rejected under 35 U.S.C. 102(e) as being anticipated by

U.S. Pat. No. 5,999,737 to Srivastava.

With respect to claim 1, Srivastava discloses a method for removing dead code in code

fragments of a program (see column 3, lines 6-12), comprising:

(a) processing a first code fragment and storing first information generated during this

processing indicative of whether an instruction for assigning a register in a first code fragment is

possibly live (see column 9, lines 15-16, which shows analyzing a procedure or code fragment to

determine the liveliness of registers used by the procedure; see also column 10, lines 38-46, which shows the liveliness information stored during the analysis);

(b) processing a second code fragment and storing second information generated during this processing indicative of register usage (see column 9, lines 15-16, which shows analyzing a procedure or code fragment to determine the liveliness of registers used by the procedure; see also column 10, lines 38-46, which shows the liveliness information stored during the analysis, and which further shows analyzing a second procedure or code fragment);

(c) at a time when the first and second code fragments are to be linked, determining by use of the first and second stored information, if an instruction in the first code fragment that assigns a register is a dead instruction (see column 3, lines 3-6, which shows performing a liveliness analysis at link time; see also column 10, lines 9-14, which shows using stored liveliness information; see also column 10, lines 23-31, which shows determining whether instructions that reference a register are dead instructions); and

(d) responsive to determination that an instruction is a dead instruction, eliminating the dead instruction (see column 10, lines 9-14, which shows dead code removal; see also column 10, lines 23-31, which shows eliminating instructions determined to be dead instructions).

With respect to claim 4, Srivastava further discloses the limitations wherein:

(a) the first information includes information associated with each exit from the first code fragment (see column 7, lines 38-46, which shows classifying exit blocks in a procedure; see also column 8, lines 6-12, which shows storing information for each code block);

(b) the second information includes information associated with each entry into the second code fragment (see column 7, lines 38-46, which shows classifying entry blocks in a procedure; see also column 8, lines 6-12, which shows storing information for each code block);

(c) the linking of the first and second code fragments links a particular exit from the first code fragment to a particular entry into the second code fragment (see Fig. 6, which shows a particular exit from the first procedure linked to a particular entry into the second procedure);

(d) the step of determining uses the first information associated with the particular exit and the second information associated with the particular entry (see column 10, lines 38-46, which shows using the liveliness information to find dead instructions).

With respect to claim 5, Srivastava further discloses the limitation wherein the first information associated with each exit includes a pointer to each instruction for assigning a register that is possibly live (see column 10, lines 1-7, which shows that the information precisely states variable utilization and register usage in the program; note that this information inherently comprises pointers to the instructions that use the registers).

With respect to claim 11, see the explanation for claim 1 above. Note that Srivastava further discloses a computer readable medium comprising executable instructions (see column 3, lines 57-63).

With respect to claim 14, see the explanation for claim 4 above.

With respect to claim 15, see the explanation for claim 5 above.

Claim Rejections - 35 USC § 103

5.   The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6.   Claims 2 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Srivastava, as applied to claims 1, 4, 5, 11, 14 and 15 above, in view of U.S. Pat. No. 6,112,025

to Mulchandani et al. (hereinafter Mulchandani).

With respect to claim 2, Srivastava does not expressly disclose the limitation wherein

eliminating the dead instruction comprises overwriting the dead instruction with a NOP.

Srivastava does show removing dead instructions (see column 10, lines 28-31).

Mulchandani discloses the limitation above in a dynamic linking system (see column 5,

lines 30-37, which shows replacing an instruction with a NOP) for the purpose of preventing the

unwanted effects of executing a particular instruction (see column 5, lines 42-50).

It would have been obvious to one of ordinary skill in the art at the time the invention

was made to modify the system of Srivastava with the replacement feature taught by

Mulchandani for the purpose of preventing the unwanted effects of executing a particular

instruction.

With respect to claim 12, see the explanation for claim 2 above.

7.   Claims 3 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over

Srivastava, as applied to claims 1, 4, 5, 11, 14 and 15 above, in view of U.S. Pat. No. 6,041,179

to Bacon et al. (hereinafter Bacon).

With respect to claim 3, Srivastava does not expressly disclose the limitation wherein

eliminating the dead instruction comprises compacting the surrounding instructions to delete the

dead instruction.

Srivastava does show removing dead instructions (see column 10, lines 28-31).

Bacon discloses the limitation above for the purpose of reducing code size (see column 11, lines 9-13, which shows compacting code in a program by linking only live procedures and not including those determined to be dead).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Srivastava with the code compaction feature taught by Bacon for the purpose of reducing code size.

With respect to claim 13, see the explanation for claim 3 above.

8.   Claims 6-10 and 16-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Srivastava, as applied to claims 1, 4, 5, 11, 14 and 15 above, in view of U.S. Pat. No. 6,408,433 to Click, Jr. et al. (hereinafter Click).

With respect to claim 6, Srivastava does not expressly disclose the limitation wherein the first information associated with each exit further includes a first register mask, the first register mask having a plurality of positions, each position corresponding to a respective register, wherein a bit at a position is set if the respective register is assigned in an instruction pointed to by a pointer in the first information associated with that exit.

Srivastava does show liveliness information that is used both to determine variable and register utilization across linked procedures (see column 10, lines 1-14), and to find instructions that access particular registers (see column 10, lines 28-31).

Click discloses the limitation above in terms of a register mask having a plurality of bits that are used to indicate which registers are associated with a particular variable (see column 7, lines 50-53), for the purpose of describing the locations associated with a calling convention (see

column 8, lines 12-14). Note that in terms of dead code elimination, the calling convention

specifies how registers are to be used when procedures are called (see column 1, lines 54-67, and

column 2, lines 1-7).

It would have been obvious to one of ordinary skill in the art at the time the invention

was made to modify the system of Srivastava with the register mask feature taught by Click for

the purpose of describing the locations associated with a calling convention, which specifies the

use of registers in procedure calls.

With respect to claim 7, Srivastava does not expressly disclose the limitation wherein the

second information associated with each entry includes a second register mask, the second

register mask having a plurality of positions, each position corresponding to a respective register,

wherein a bit at a position is set if the respective register is assigned in the second fragment

before being read.

Srivastava does show liveliness information that is used both to determine variable and

register utilization across linked procedures (see column 10, lines 1-14), and to find instructions

that access particular registers (see column 10, lines 28-31).

Click discloses the limitation above in terms of a register mask having a plurality of bits

that are used to indicate which registers are associated with a particular variable (see column 7,

lines 50-53), for the purpose of describing the locations associated with a calling convention (see

column 8, lines 12-14). Note that in terms of dead code elimination, the calling convention

specifies how registers are to be used when procedures are called (see column 1, lines 54-67, and

column 2, lines 1-7).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Srivastava with the register mask feature taught by Click for the purpose of describing the locations associated with a calling convention, which specifies the use of registers in procedure calls.

With respect to claim 8, Srivastava does not expressly disclose the limitation where said determining step comprises comparing corresponding positions of the first and second register masks, wherein said eliminating step includes eliminating an instruction for assigning a register in the first code fragment if the positions corresponding to the register in the first and second register masks are both set.

Srivastava does show removing the instructions that reference dead registers (see column 10, lines 28-31).

Click discloses the limitation above in terms of finding the intersection of several register masks, for the purpose of determining the live range of a variable (see column 8, lines 15-22).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Srivastava with the mask intersection feature taught by Click for the purpose of determining when a variable is live.

With respect to claim 9, Srivastava further discloses the limitation wherein said elimination step further comprises determining which instruction to overwrite with reference to the pointers in first information (see column 10, lines 1-14, which show liveliness information that is used to determine variable and register utilization and to remove dead code; see also column 10, lines 28-31, which shows determining which instructions to remove).

With respect to claim 10, Srivastava does not expressly disclose the limitation wherein the first information associated with each exit is stored in an epilog and the second information associated with each entry is stored in a prolog associated with that entry.

Srivastava does show classifying entry and exit blocks in a procedure (see column 7, lines 38-46) and storing information for each such block (see also column 8, lines 6-12).

Click discloses the limitation above in terms of using a register allocator to build calling convention prolog and epilog code (see the title and abstract; see also column 6, lines 38-56, which shows building the prolog and epilog), in order to allow greater flexibility and faster execution (see column 6, lines 21-25). Note that in terms of dead code elimination, the calling convention specifies how registers are to be used when procedures are called (see column 1, lines 54-67, and column 2, lines 1-7).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the system of Srivastava with the prolog and epilog features taught by Click for the purpose of allowing greater flexibility and faster execution.

With respect to claim 16, see the explanation for claim 6 above.

With respect to claim 17, see the explanation for claim 7 above.

With respect to claim 18, see the explanation for claim 8 above.

With respect to claim 19, see the explanation for claim 9 above.

With respect to claim 20, see the explanation for claim 10 above.

Conclusion

9.   The prior art made of record and not relied upon is considered pertinent to applicant's

disclosure. U.S. Pat. No. 6,044,221 to Gupta et al. discloses a method for eliminating dead code

using path profiling.

10.   Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Michael J. Yigdall whose telephone number is (703) 305-0352.

The examiner can normally be reached on Monday through Friday from 8:00am to 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Tuan Q. Dam can be reached on (703) 305-4552. The fax phone number for the

organization where this application or proceeding is assigned is (703) 746-7239.

Any inquiry of a general nature or relating to the status of this application or proceeding

should be directed to the receptionist whose telephone number is (703) 305-3900.

Michael J. Yigdall
Examiner
Art Unit 2122

mjy
November 12, 2003

JOHN CHAVIS
PATENT EXAMINER
ART UNIT 2124